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ABSTRACT

A Task Force created in 1989 was asked to provide the Carnegie Commission on Science, Technology, and Government with a brief statement outlining both functional needs in environment and energy and institutional forms to enhance the government's capability to address the emergent issues. One key need the Task Force has identified is for a greater emphasis on developing and structuring incentives to prevent environmental problems, rather than responding to problems only after they occur. A second need is to grapple with the multitude and subtlety of interfaces between issues, not only of environment and energy, but of the economy as well. This report suggests that there is an abundance of organizations that deal with specifics, but not with their integration. Discussions include: (1) limitations of command and control; (2) linking economic and energy needs to the environment; (3) international dimensions; (4) short and long term objectives; (5) matching organizations to the problem; and (6) coordination between existing systems. Key and supporting recommendations of the Task Force have been included. Appended is a discussion on the greenhouse effect as an illustration of the linkages between the environment, energy, and the economy. (KR)

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Carnegie Commission on Science, Technology, and Government
Task Force on Environment and Energy

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Carnegie Commission on Science, Technology, and Government

In a world rapidly transforming itself through science and technology (S&T), institutions and decision-making processes must continually evolve to make the most effective and humane use of scientific and technological capabilities and to meet the demands of new situations. The past fifty years have been characterized by an extraordinary growth and development of organizations concerned with science and technology and of scientific and technical components of organizations traditionally little involved with science and technology. The expectation for coming decades can only be that science and technology will further suffuse human society and decision-making, whether at international, national, or state levels, whether in executive agencies, legislatures, or courts. Existing organizations will change to adapt to and to influence the new environment; new institutions will be created to accommodate new needs; and rules and processes will be modified and invented to adjust and optimize the functioning of the system.

The main purpose of the Carnegie Commission on Science, Technology, and Government is to seek ways in which the branches of the U.S. government can encourage and better use the contributions of the nation's scientists and engineers. The Commission is unique in its long-range focus on more effective mechanisms by which the federal government, states, and international organizations in which the United States plays a major role can incorporate scientific and technical knowledge into policy and administrative decision-making.

The Commission seeks to bring about desired changes through defining and drawing attention to opportunities for improvement and innovation in institutions and decision-making processes. These may relate to the establishment of new institutions; adjustment of incentives; reorganization; legislation; or strengthening of mechanisms for participation, education, and coordination.

The first report of the Commission, issued in October of 1988, addressed the question of "Science & Technology and the President." The report explored Presidential-level issues involving science and technology and made recommendations for organization for S&T within the Executive Office. Subsequent reports of the Commission will address such topics as organization of the federal government for economic performance; science, technology, and the Congress; science and the Judiciary; and science and technology in organizations concerned with international development.

The Commission and its Advisory Council consist of eminent scientists, engineers, scholars, heads of science- and technology-based industries, educators, former government officials, and other leaders in the public and private sector with direct experience of the uses of science and technology in policy development. The Commission was formed in 1988 by Carnegie Corporation of New York at the initiative of its president, David A. Hamburg. It is chartered for five years.

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E^3: Organizing for Environment, Energy, and the Economy in the Executive Branch of the U.S. Government

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PREFACE

Over the past twenty five years, the terms of the environmental debate have shifted from small and seemingly discrete problems to much larger, more complicated, and embracing ones that ultimately relate to the possible destruction of the human habitat and of nature itself. In order to translate the new environmental understanding into effective polices, organization and decision-making must rise to a higher level, both in the United States and internationally.

Recognizing the urgency of the need, the Carnegie Commission on Science, Technology, and Government established its first Task Force to examine how the Executive Branch of the U. S. Government might strengthen its ability to deal with problems in the intimately related areas of environment and energy. The Task Force, chaired by Commissioner H. Guyford Stever and made up of distinguished experts who were not members of the Commission, was created in the spring of 1989. It was asked to provide the full Commission with a brief statement outlining both functional needs in environment and energy and institutional forms to enhance the government's capability to address the emergent issues.

One key need the Task Force has identified is for a greater emphasis on developing and structuring incentives to prevent environmental problems, rather than responding to problems only after they occur. A second need is to grapple with the multitude and subtlety of interfaces between issues, not only of environment and energy, but of the economy as well. The following report suggests accurately that there is an abundance of organizations that deal with specifics, but not with their integration.

President Bush's speech to the Intergovernmental Panel on Climate Change on February 5, 1990, clearly recognizes the interrelation of environmental and economic issues and also cites the review and revision of a national energy strategy that will include environmental considerations. Effective integration and implementation of these policies requires, over the long term, further strengthening or adjustment of the present institutional mechanisms in order to deal with the many issues that are certain to arise in the next decades. The need to link the planning of scientific research, assessment of impacts, and policy formulation and implementation requires a sustained linking capability at the highest level of government. The mechanisms that have evolved over the past year, while able to deal effectively with specific urgent issues, are not, in the view of the Task Force, sufficiently institutionalized to predict future problems and opportunities, or to react swiftly to them. In the long term, there is a need for a sustained mechanism responsible for integrated policy analysis, able to identify tradeoffs and policy options using information from the departments and agencies, and this mechanism should be permanently associated with a policy group in the White House that considers the options and makes recommendations to the President.

To fulfill this central goal, the Task Force has formulated three organizational alternatives that might be helpful. Detailed evaluation of these alternatives, as well as development of others, should be carried forward by those in the government who are best placed to identify practical advantages and disadvantages that inevitably are connected to the current, specific historical context. At the same time, the Commission hopes that by presenting this report it will stimulate a much broader discussion within the Executive Branch, the Congress, the media, and of the interested public about how the institutions of the U.S. government can best be adapted in coming years to face a daunting array of challenges related to environment, energy, and the economy.

The Commission recognizes that a strong U.S. institutional foundation in the area of environment and energy is a vital, though only partial, basis for addressing what are, in large part, global problems. Subsequent efforts of the Commission will consider selected international institu-

tional dimensions.

The Commission endorses this report and thanks the members of the Task Force and the staff for a timely and thoughtful contribution. An earlier draft was reviewed by both the Commission and its Advisory Council. We all look forward to working with concerned parties in the further definition of the vision and implementation of the recommendations presented in this report.

William T. Golden
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EXECUTIVE SUMMARY

The United States needs basic changes in the institutional, as well as legal, arena to minimize conflict between goals for environmental quality, energy security, and economic strength; to promote cooperation between proponents of environmental quality and advocates of economic development; and to address emerging environmental issues, especially those on a global scale. The environment-energy-economy, or E^3, issue is one of the most complex facing government, for it combines economics, science, and technology with major social and international concerns. It has short-term aspects, such as oil spills and the worsening air breathed daily by many of our people; medium-term aspects, such as the deterioration of our forests, streams, soil, and lakes associated with acid rain; and long-term aspects, such as radioactive waste disposal and global climate change.

The many faces of the environment-energy-economy challenge are, and will continue to be, of such priority that more effective organization and decision-making must be put in place in the U.S. Government. Given the excellence of our environmental sciences, our capability in many fields of energy technology, and the leverage of our economy on world economic trends, the United States can be in a position to provide world leadership in harmonizing environment and development. Global political momentum is now so great for progress toward sustainable development that, if the United States is to provide leadership, a much more alert and strategic stance is required within the government.

Four functions need to be fulfilled by the government: building the knowledge base, assessing impacts, formulating policy, and implementing policy. Quite apart from organization, the functions are difficult to fulfill for issues such as global climate change because of insufficent data and uncertainty about causes and effects, irreversibility of consequences, and international requirements for response.

More is needed than better coordination of the existing system of environmental management and decision-making. A new vision of how we can maintain and enhance environmental quality nationally and globally must define our institutions. In particular, greater use of economic incentives will help to realize the long-term compatibility of goals for environmental quality and economic strength, in part by fostering needed technological innovations.

In recent years there have been intervals of confusion within the U.S. government in policy formation on several environmental issues, most recently on climatic change. This situation reflected the absence of a top-level organizational mechanism that can address policy development and management of federal responsibilities. The Task Force recommends that actions be taken to assure the stable and sustained functioning of a high-level mechanism concerned with linking environment, energy, and the economy. The mechanism should be designed, to the greatest extent possible, to accomplish the following:

1) satisfy the needs of the President for integrated policy options and advice
2) influence the policy directions and programs of relevant departments and agencies
3) create and maintain a forum for interagency cooperation
4) combine domestic and international considerations
5) work compatibly with Congress
6) attract and retain staff of high professional standing and draw on both in-house and extramural expertise
7) connect to the states, private industry, and public and environmental groups

Recently the government has taken promising steps in the direction of institutional arrangements satisying these criteria. The President assigned to the Secretary of Energy the responsibility of developing a national energy strategy that covers short-, medium-, and long-term aspects of energy policy and takes into account economic

and environmental factors. A broadly based working group of the Economic Policy Council has been constituted to participate in the strategy formulation. The staff of the Council on Environmental Quality has been strengthened. Furthermore, the Congress has voted to elevate the Environmental Protection Agency to a cabinet-level department, a suggestion endorsed by the President.

In regard to climate, initiatives are under way in the Domestic Policy Council, and the role played by the Assistant to the President for Science and Technology and the Office of Science and Technology Policy (OSTP) is growing. OSTP's Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), through its Committee on Earth Sciences (CES), has proposed the funding of a much expanded research program on global change. Within the Domestic Policy Council, the President's Assistant for Science and Technology chairs an influential coordinating committee of agencies dealing with policy responses to, as well as research upon, climate change.

An option that may go further toward meeting the criteria identified above is a new Executive Office Council on Environment, Energy, and Economics (CE^3) that would evolve from and replace the current Council on Environmental Quality (CEQ). A second promising option is a further strengthening of the CEQ within its current framework to embrace more expertise in science, engineering, energy, and economics. A third option is the creation of a new White House Council on Environment, Energy, and the Economy, composed of leaders of existing organizations that have authority and responsibilities in relevant areas.

The Task Force also recommends that the Carnegie Commission's own groups that are beginning study of science, technology, and the Congress consider ways to bring together disparate Congressional interests involving environment, energy, and economics. Examples of relevant current mechanisms that might be explored in this context include the Environmental and Energy Study Conference and the Joint Economic Committee. Another possible approach is the establishment for a fixed period of a new Select Committee on Environment, Energy, and the Economy.

In support of these recommendations, the Task Force suggests the following:

a) reinforcement of high-level representation in coordination between agencies conducting research on global environment and related matters;
b) an intensive review of federal monitoring efforts and responsibilities for global environment;
c) further strengthening of the capability of the State Department to analyze and to respond to foreign policy implications of issues in environment and energy; and
d) consideration of the establishment of a new, independent, forward-looking institute for environmental analysis to serve government agencies.

Sound policies in such areas as waste minimization and energy efficiency, imaginative use of economic incentives, and promotion of engineering solutions that address potential problems through design at the origin, rather than through retrofits at the "end-of-the-pipe," will strongly and simultaneously support economic growth, energy security, and environmental quality. Now is the time to match our institutions better to the task.

"Fundamental changes in concepts, in laws, and in the organizational structure of legislative and executive branch activities are essential if further progress is to be made on long-standing environmental issues and newly recognized ones alike."
— William K. Reilly, Jr. [1]

INTRODUCTION

The long-term compatibility of environmental and economic objectives has become obscured by an excessive focus on short-term objectives and on the regulatory tools developed to achieve them. The United States needs basic changes in the institutional, as well as legal, arena to minimize this conflict, to promote cooperation between proponents of environmental quality and advocates of economic development, and to address emerging environmental issues, especially those on a global scale. Much progress has been made on the environmental agenda by institutional and legislative means over the past twenty years, but there are signs that the environmental agenda of the future will diverge in increasingly troublesome ways from the one that our current governmental decision-making arrangements are designed to address. Neither the environmental agenda nor other related social objectives will be well served simply by relying on the status quo.

In the late 1960s, there was widespread agreement that the governmental system had not responded adequately to environmental problems. In response, the Environmental Protection Agency (EPA), the National Oceanic and Atmospheric Administration (NOAA), the Occupational Safety and Health Administration (OSHA), and the White House Council on Environmental Quality (CEQ) were all created around 1970 as fresh, stronger mechanisms for focusing America's efforts on a range of environmental issues. Today, there is once again a sense that existing mechanisms are inadequate to address environmental issues, particularly as these issues intersect with issues of economic growth, energy use, and international affairs. Enhanced and probably different mechanisms are needed at high levels of government to connect the analyses of various issues and to provide leadership in their management.

The Task Force believes that now is the time for the government to examine thoroughly the adequacy of its organization and decision-making processes for environmental quality as it relates to energy and economic growth. The next few years should be another formative period for organization and decision-making processes regarding the environment, both domestically and internationally. Failure to orient our government's environmental institutions and decision-making processes to present and emerging conditions will be costly to the people of the United States in both monetary and non-monetary terms. In turn, failure by the United States to develop its capability to contribute to progress on global environmental issues could have major implications for all our planetary neighbors.

The economic issues are already large. The United States now spends more than $70 billion per year to meet the requirements of the Clean Air and Clean Water Acts and the Resource Conservation and Recovery Act.[2] The nation faces a clean-up price tag for Superfund sites of approximately $1 trillion.[3] Part of the reason that costs are this high is that the United States has relied heavily on an "end-of-the-pipe" approach, cleaning up a problem after it occurs. This approach is not only often ineffective, it is also very expensive. Only 1 percent of the $70 billion now spent is devoted to prevention of pollution. The nation needs to move in the direction of pollution prevention, especially through waste minimization, energy efficiency, and more environmentally compatible energy supply strategies.[4] The government needs to develop institutions that will advance this process.

Limitations of Command-and-Control

Traditionally, the U.S. government has depended heavily on a "command-and-control" strategy to achieve environmental goals. This strategy may be characterized in simple terms as relying on an elaborate system of planning in which a central administration imposes production quotas on different plants and industries through directives specifying the amount of pollution allowed to escape into the air, water, and land. Because the U.S. economic system is largely

"All too often, issues will be addressed in such a way that all but the most critical aspects are dealt with...[A]lthough you can break a problem down and address solutions to the pieces, it is not a complete solution unless we can reconstitute the pieces into a whole that is consistent, realistic, and not self-contradictory."
—John H. Sununu [5]

governed by markets in goods and services, it is not surprising to find that the command-and-control approach has met with limited success in attaining the goals set for it. Among the evident shortcomings of the current system are the pressures it creates for noncompliance by such means as simply moving pollution from one medium to another, less-regulated medium; illegal dumping and other evasive activity; and costly and time-consuming litigation.[6]

The greenhouse issue, which is in fact one of a class of complex global issues for which new management mechanisms are needed, demonstrates the limitations of applying command-and-control regulation to new problems (see Appendix). Energy use, the main source of greenhouse gases, is so pervasive in all sectors of society that developing and implementing sound policies in relation to the greenhouse issue is particularly important. As hinted at by the U.S. experience in responding to the energy crises of the 1970s, attempts to regulate energy use in the traditional style could lead to a bureaucratic apparatus that would dwarf the present Environmental Protection Agency in both size and expense. More important than size and cost of such a bureaucracy is the likelihood that it would be ineffective, or effective but seriously damaging to the economy.

Consequences of Fragmentation

The complexity of the global warming issue also focuses attention on the need to consider the "system" aspects of both environmental protection and energy supply. For instance, a major element in current proposals to curb damage due to acid rain is to use flue gas scrubbers to remove sulfur from coal. Unintended consequences of successful diffusion of scrubber technology could be higher emissions and concentrations of greenhouse gases through increased reliance on coal for energy supply, a decrease in efficiency of electricity generation, and other factors. Clearly, the coal that is burned should be burned as cleanly as possible, but more careful thought and analysis should accompany investments in such partial "solutions" that may tend to lock energy systems into sources and technologies that could seriously exacerbate other environmental problems. Any energy strategy, whether emphasizing hydrocarbons, nuclear power, renewable sources, management of energy demand, or efficiency will have complicated environmental and economic implications, and these need to be considered by the government in a comprehensive, integrated fashion.

The United States and other countries are caught in a costly, confusing web of issues because the links between and among the environment, energy, and the economy, as well as the links among environmental issues, have been neglected.

Linking Economic and Energy Needs to the Environment

Economic considerations have, of course, always figured in U.S. environmental policy. Much of the economic dimension has been associated with cost-benefit analyses of proposed environmental regulations. Beginning with the relatively simple "quality of life" reviews stemming from the National Environmental Protection Act (NEPA) passed in 1969, requirements for these analyses grew, particularly with the issuance of Executive Order 12291 in 1981, which requires agencies to prepare Regulatory Impact Analyses for most major regulations. Cost-benefit analyses have been useful in eliminating inefficient alternatives and in stimulating the search for alternatives, among other outcomes.[7] Economic arguments have sometimes been used to justify inaction on environmental matters. In general, environmental protection has been analyzed in a framework that puts it in opposition to economic growth.

A new and more constructive intellectual focus is now necessary for economic research and analysis related to the environment.[8] There is a

need, for example, to identify and provide incentives to develop processes and products that increase energy efficiency and reduce the production of waste. Opportunities and incentives for innovation and investment that would benefit both the economy and the environment through waste reduction have been either neglected or foreclosed by the prevailing command-and-control strategy. Waste reduction and energy efficiency are complementary and make good economic sense. Prevention of pollution can often pay for itself through reduced demand for inputs, reduction in waste disposal and liability costs, and other means.[9] Indeed, achieving reductions in production of waste or the amount of energy required by waste-producing industrial processes can contribute significantly to the competitiveness of U.S. industries.

Numerous experts have argued in recent years that more flexible market-based approaches could help achieve environmental goals, including pollution prevention, in a more timely and less costly way than traditional regulation.[10] Incentive-based systems would involve such mechanisms as emission fees and marketable permits. Experimentation with such new approaches, with which there is still little operational experience, appears increasingly necessary in light of the insufficiency of traditional approaches for issues like global climate change and ozone depletion, as well as non-point-source pollution of surface and ground water, solid waste disposal, and buildup of pesticides and toxic substances.[11] Adjusting the details of the current system seems unlikely to solve either lingering or emerging environmental problems, nor will it adequately promote the long-run complementarity between economic and environmental objectives. There is a need to look beyond the short-run perspectives of "environmentalists" and "polluters," and past the status quo of environmental regulation, to environmentally compatible systems of production and consumption promoted by economic incentives and to institutions and decision-making processes that foster these systems.

International Dimensions

Issues such as global warming, deforestation, acid rain, stratospheric ozone depletion, and ocean dumping also illustrate the international character of sources, solutions, and consequences of environmental problems. An international assessment of climate change is now in full swing for the United Nations (UN) General Assembly under the auspices of the Intergovernmental Panel on Climate Change (IPCC).[12] The IPCC is scheduled to report its findings in the fall of 1990 to the ministerial level World Climate Conference as well as to the UN General Assembly. The IPCC process is forcing U.S. government agencies to take a more unified view with regard to the greenhouse effect. Pluralism of agency positions has been reflected in the sometimes inconsistent views on this issue presented by the United States in different international forums during 1988 and 1989.[13]

The government is facing increasingly difficult questions on the international front, especially as the subjects addressed in negotiations on matters such as "climate protocols" shift from simply environmental science and monitoring to international trade and industry. The mechanisms needed to deal with the many facets of environmental issues on the international level are not currently apparent. What mechanisms exist in the U.S. government for arriving at sound U.S. positions with regard to "global trust funds" for the environment? What mechanisms are appropriate for evaluating the need to strengthen existing international organizations concerned with environment and development? What mechanisms can effectively foster the transfer of energy efficient and waste minimizing technologies to the developing world? What mechanisms can follow through effectively on the proposals made by President Bush in Germany and Hungary in the spring and summer of 1989 for the creation of innovative, new institutions to address needs for environmentally sustainable economic growth? In this report, the Task Force seeks to make recom-

"Increasingly, policymakers and industrial leaders are recognizing that the two issues—global habitability and global economic growth—are inextricably linked."
—Robert M. White[14]

mendations that are responsive to the felt need for such mechanisms.

Harmonizing Short- and Long- term Objectives

The many faces of the environment-energy challenge are, and will continue to be, of such priority that more effective organization and decision-making must quickly be put in place within the U.S. government. Given our excellence in environmental sciences, our capability in many fields of energy technology, and the leverage of our economy on world economic trends, the United States can be in a position to provide world leadership in harmonizing environment and development. Global political momentum is now so great for progress toward sustainable development that, if the nation is to provide such leadership, a much more alert and strategic stance is required.

The environment-energy issue is one of the most complex facing the federal government, for it combines economics, science, and technology with major social and international concerns, and it combines them on all time scales. It has short-term aspects, such as oil spills and the worsening air breathed daily by many of our people; medium-term aspects, such as the deterioration of our forests, streams, soil, and lakes associated with acid deposition; and long-term aspects, such as radioactive waste disposal and global climate change. A redeeming feature of the challenge is that several key steps that nations should take to mitigate short-term effects will help for the longer term as well.

The current debates among nations and within the U.S. government about the possible dangerous acceleration of global climatic change associated with increases in greenhouse gases strongly signal the emerging need for better governmental organization and decision-making processes. Greenhouse warming is a new issue for the political system and is thus less encumbered with interests vested in the present system of environmental management. It therefore provides a valuable opportunity and a fresh impulse to avoid difficulties encountered previously in attempting to deal with classical pollutants through the command-and-control regulatory strategy and through fragmented and adversarial agency activities.

Matching Organization to the Problem - A Functional Approach

The Federal Government has difficulty with the environment-energy issue in considerable part because the problem does not easily match the existing organization of the Administration. In addressing the problem independent of organization, there are four somewhat distinct and partially separable functions that must be carried out:

1) to conduct the scientific research, monitoring, and data gathering to ascertain the root causes of the problem (the knowledge base); 2) to determine the nature and extent of the adverse and beneficial effects and impacts, evident or potential, of all root causes (impact assessment); 3) to determine needed preventive and mitigating actions and policies and their benefits and costs (policy formulation); 4) to proceed with the remedies (policy implementation).

Clearly, these four functions need to be performed in dealing with any major policy issue. Quite apart from organization, the functions are especially messy for an issue like global climate change. Among the reasons are the following:

1) Uncertainty. The knowledge base, the benefits of emission reductions and of adaptive actions, and even the costs of such preventive and adaptive strategies are uncertain and will remain so for the foreseeable future. Among the reasons for the uncertainty are shortfalls in reliable data, the inherent unpredictability of some phenomena, and inadequate analytic tools, as well as gaps in research efforts and analysis in some areas.

2) Irreversibility. Both the environmental consequences and the social and economic behavior that may generate them may be exceptionally

difficult to reverse or change. It takes much less time for human activities to build up the concentration of greenhouse gases than for natural processes to dissipate them. In fact, once the concentration of carbon dioxide, the main greenhouse gas, is significantly elevated in the atmosphere, it is likely to remain that way for several centuries. Moreover, when a society has a major commitment to an energy source like coal, it takes fifty or more years to substitute another source of supply on a large scale because of the extensive infrastructure developed for extracting, transporting, storing, and using the energy source and of all the jobs and income associated with it.

3) International requirements. Policy implementation involves many countries, in some instances demanding cooperation without which domestic measures would fall short of the global requirements. For example, addressing some facets of global environmental change will probably include assistance to developing countries for diffusion of environmentally compatible technologies and emission management within the borders of the United States and other industrialized nations.

Because of the uncertainty surrounding environmental change and the high potential for irreversibility, research and policy must be very closely linked. In fact, all four functions of research, impact assessment, and policy formulation and implementation must be closely linked. Moreover, because of the transnational features of the issue, domestic and international considerations also require close linkages.

Expressed in the functional approach, one can immediately see the difficulty the Federal Government has and will continue to have in increasing measure, because quite different White House councils and Executive Branch departments and agencies, as well as Congressional committees, have varying responsibilities, capabilities, and work assignments.[15] The U.S. government organization is not congruent to the four basic functions and would be challenged to perform and integrate them well, even if they were easy to execute.

A New Vision

In recent years there have been intervals of confusion within the U.S. government in policy formation on several environmental issues, such as global warming. It has been correspondingly unclear to whom in the government concerned parties outside the government should address policy questions. Moreover, portions of existing organizations are oriented toward strategies that may make addressing specific environment-energy problems more difficult. For example, a substantial fraction of the Department of Energy's (DOE) effort is devoted to promoting and expanding coal as an energy source, and the EPA is mainly structured to implement command-and-control regulation that simply cannot address the countless sources of greenhouse gas emissions.

Therefore, more is needed than better coordination of the existing system. A new vision of how the United States is to maintain and enhance environmental quality nationally and globally must inform its institutions. These institutions must be designed to embrace environmental, energy, and economic goals harmoniously and coherently and to perform at the highest capability the functions of securing the knowledge base, assessing impacts, and formulating and implementing policies with both national and international dimensions.

Promising steps have recently been taken in this direction. In a speech to the IPCC February 5, 1990, President Bush clearly recognized the convergence of environmental, energy, and economic issues.[16] The President has directed the Secretary of Energy to provide a national energy strategy that covers short-, medium-, and long-term aspects of energy policy and takes into account economic and environmental factors. A broadly based working group of the Economic Policy Council has been constituted to participate

in the strategy formulation. The staff of the Council on Environmental Quality has been strengthened. Furthermore, the Congress has voted to elevate the Environmental Protection Agency to a cabinet-level department, a suggestion endorsed by the President.

In regard to the climate issue, initiatives are under way in the Domestic Policy Council, and the role played by the Assistant to the President for Science and Technology and the Office of Science and Technology Policy (OSTP) is growing. OSTP's Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), through its Committee on Earth Sciences (CES), has proposed the funding of a much expanded research program on global change. Within the Domestic Policy Council, the President's Assistant for Science and Technology chairs an influential coordinating committee of agencies dealing with policy responses to, as well as research upon, climate change. The National Security Council's Policy Coordinating Committee on Oceans, Environment, and Science has also played a helpful role.

Key Recommendations of the Task Force

1. Improve the Top-Level Mechanism in the Executive Branch

The breadth of interests and activity suggests a first recommendation, namely that a top-level policy mechanism is needed with a broader policy mandate. The Task Force recommends that actions be taken to assure the stable and sustained functioning of a high-level mechanism concerned with linking environment, energy, and the economy. To arrive at a decision about ways of addressing the need for an enhanced high-level mechanism, it is useful to identify criteria that it should meet. Such criteria include the following:

1) satisfy the needs of the President for integrated policy options and advice;
2) influence the policy directions and programs of relevant departments and agencies;
3) create and maintain a forum in which agencies can challenge one another in a constructive way as well as develop government-wide plans for research and monitoring, impact assessment, and policy formulation and implementation;
4) combine domestic and international considerations;
5) work compatibly with the Congress;
6) attract and retain staff of high professional standing and draw on both in-house and extramural expertise; and
7) connect to the states, private industry, and public and environmental groups.

In considering alternatives for a high-level mechanism, the Task Force considered organizational models used to address partly analogous past situations, such as the Law of the Seas and Antarctic negotiations and the Vienna Convention and Montreal Protocol negotiated in response to the endangering of the ozone layer. Among the commonly employed approaches in such situations has been the designation of a "czar" (or special ambassador) or a lead agency. The Task Force evaluated such options against the "test case" of the climate change issue.

There have been various proposals for the appointment of a "Climate Czar" (for example, proposed legislation S. 201 and S. 603). "Czars" are often helpful in the short-run for focusing governmental and public attention on an issue. The climate change issue, because it will likely persist for many decades, if not indefinitely, does not seem well-suited for an administrative solution that is ad hoc and highly dependent on one individual. Moreover, the Task Force believes that the difficulties in handling the climate change issue that have been evident within the government are symptomatic of a broad syndrome in the way the United States often deals with environment, energy, and the economy. The Task Force thus concludes that the federal government should in general refrain from setting up a special high-level unit devoted solely to single environ-

mental issues such as global climate change. The often disappointing experience with ad hoc arrangements reinforces the need to have a better standing framework in which to develop organization and decision-making processes for particular environmental issues.

The Task Force also concludes that it is preferable not to rely on designation of a single lead agency when an environment-energy issue such as climate change arises. To continue with the climate example, while it is clear that the DOE and the EPA have the greatest concern with the issue, overall leadership of the issue should be within the Executive Office of the President because of the necessity for cooperation and coordination among many agencies, especially DOE and EPA, but also the Departments of State, Commerce, Agriculture, Interior, and Transportation, the National Science Foundation, the National Aeronautics and Space Administration, and others.[17]

Overall, the Task Force concludes that neither a "czar" approach nor a lead agency approach is likely to satisfy many of the criteria identified above. Changes in federal institutions and decision-making processes related to the climate issue should be approached generically, not as special cases. The Task Force also thinks it is evident that Executive Office units such as the Council on Environmental Quality, Office of Science and Technology Policy, Economic Policy Council, and Domestic Policy Council in their current forms are not sufficiently staffed to address the environment-energy-economy question in a sustained way. The Task Force thus explored options for further organizational development of the top-level mechanism adumbrated above.

Option A: A New Executive Office Council on Environment, Energy, and the Economy

An option that the Task Force believes might succeed especially well in meeting many of the criteria stated above would be the establishment of a new Executive Office Council on Environment, Energy, and the Economy (CE^3). This new Council would have as its central charter the understanding and harmonization of national, as well as international, concerns of the United States with respect to environment, energy, and the economy and the identification of appropriate policies. The CE^3 would represent an evolution of the present Council on Environmental Quality and would replace that body.[18] The CE^3 would work closely with other Executive Office units, particularly the Council of Economic Advisors, Domestic Policy Council, Economic Policy Council, National Security Council, Office of Management and Budget, Office of the U.S. Trade Representative, and Office of Science and Technology Policy. The CE^3 might naturally have three members, each of whom would have special expertise on one of the three areas whose intersection would be the Council's central concern.

Option B: Strengthening the Council on Environmental Quality

A second option is to strengthen the CEQ within its current framework. The charter of the CEQ, as laid out in Executive Order 11514 (1970) is broad: to assist the President in the national effort to meet national environmental goals. The language of the Order reflects the era in which it was prepared, emphasizing control of pollution, development and enforcement of standards, and oversight of the preparation of environmental impact statements. Nevertheless, the Order would permit activities with the orientation proposed here through its general mandate to determine policies and programs for environmental problems not being adequately addressed and through its directive to coordinate federal programs and assist in achieving international cooperation.

In practice, as indicated, the CEQ has defined its activities rather narrowly over the past decade, preparing the annual Environmental Quality report mandated by the National Environ-

mental Protection Act (NEPA) and working on particular legislative initiatives. To meet the goals laid out here, a renewed commitment would be needed by CEQ to a broad interpretation of its charter.[19] Also, it would be necessary to complement the expertise in legal matters that has been the principal strength of the CEQ staff since the mid-1970s with much more expertise in science, engineering, energy, and economics. An outside advisory committee of leading experts in environment, energy, and economics might further assist the CEQ to meet the challenges discussed in this report. The Task Force notes the section in the President's FY 1991 budget entitled "Revitalizing CEQ."[20]

Option C: A White House Council on Environment, Energy, and the Economy

A quite different alternative would be a new, environmentally oriented White House Council composed of leaders of existing organizations in the Executive Office of the President that have authority, responsibilities, and networks in this area. These criteria suggest inclusion of the Council on Environmental Quality, the National Security Council, the Council of Economic Advisors, the Office of Management and Budget, and the Office of Science and Technology Policy as well as the Economic Policy Council and Domestic Policy Council. Such a White House Council, supported by a high-level executive director and good staff, could be effective if it has clear authority from the President to recommend policy and to assign actions to agencies to implement approved policy.[21] A variation on this option would be the establishment of a permanent committee of the Domestic Council on E^3.

As noted earlier, numerous agencies of the government will be involved in carrying out one or more of the functions described earlier in relation to such issues as global climate change. The principal Executive Office mechanisms, aside from the Cabinet itself, that involve many operating agencies are the Economic Policy Council and the Domestic Policy Council. As mentioned earlier, the Domestic Policy Council has active working groups in the climate area. The Domestic Policy Council includes the Secretaries of Energy and Interior and the Administrator of the EPA, giving it significant strengths in addressing issues at the intersection of environment, energy, and economics. The Domestic Policy Council does not, however, customarily include the heads of the Departments of Commerce, State, and Agriculture, who also have strong interests in questions such as climate change. In contrast, the Economic Policy Council includes Commerce, State, Agriculture, and Transportation, but does not customarily include DOE or EPA. From this perspective, either Council, appropriately supplemented (at least on an issue-specific basis), would appear well-positioned to serve as the cabinet-level mechanism for reviewing recommendations that might emerge from the new CE^3, the enhanced CEQ, or other alternative before the recommendations go to the President, and to act upon those that receive approval.

2. Promote Coordination of E^3 in the the Congress

To promote a dialogue between the Congress and the Executive Branch on complex matters involving environment, energy, and the economy, it is desirable to have a Congressional capability for consideration of the issues in a coordinated and coherent framework. Some thirty two bills and resolutions relating to global environmental change were introduced in the 100th Congress, and more than one dozen bills are pending in the 101st Congress in this area. Because such issues cut across many Congressional committees, legislative authority is fragmented, and responsibilities are unclear. A clarification of authorization and appropriation responsibilities would expedite agreement on matters relating to environment, energy, and economics and would facilitate evaluation of broad, cross-cutting issues like global environmental change.

The Carnegie Commission has established a Committee on Science, Technology, and the Congress and a Congressional Advisory Council

"[S]ince 'environment' cuts across our national interests every bit as much as economic issues do, I suggest that it is time to rationalize Congressional authority on a more integrated basis. I realize that previous efforts along this line have had an unhappy history. Nevertheless, I urge that the Congress keep trying. How can any legislator form a coherent view of interrelated environmental issues when they are dispersed among nearly 20 full committees in the House and Senate, and perhaps four dozen subcommittees?
— Russell E. Train[22]

consisting of members of Congress to examine ways to strengthen Congressional capacity to deal with science and technology issues. The environment-energy-economics area would serve as a useful case study in the Committee's deliberations about cross-cutting issues.

Among the relevant current mechanisms that can bring together disparate Congressional interests are the Environmental and Energy Study Conference and the Joint Economic Committee. Novel approaches to addressing these problems are also worthy of consideration. For example, the Congress could establish a Select Committee on Environment, Energy, and the Economy for a fixed period, perhaps two years, to help resolve contradictory legislative developments in this area and stimulate and complement action by the Executive Branch. Such a Select Committee could draw upon a range of Congressional committees concerned with environment, energy, natural resources, science and technology, and other fields and would build upon the success of the Environmental and Energy Study Conference and Institute. Other approaches might also be feasible.

Supporting Recommendations

Along with the principal recommendations outlined above for strengthening Executive Branch organization and exploring Congressional capabilities, the Task Force offers the following supporting recommendations designed to help bring about cohesive, constructive, sustained government action in the areas of environment, energy, and the economy.

1. Reinforce high-level representation in coordination between agencies conducting research on global environment and related matters

To enhance promising initiatives in research coordination on global environmental change, the Task Force recommends reinforcing the high level at which interagency coordination on research is carried out. There have been significant achievements in research coordination by the Committee on Earth Sciences of the Federal Coordinating Council on Science, Engineering, and Technology (FCCSET, the interagency coordinating body for science and technology). The Director of OSTP, as the Chairman of FCCSET, should continue to play a direct role in government planning of research on global environment and related matters and should ensure appropriately high-level agency representation in the FCCSET effort. The new President's Council of Advisors on Science and Technology (PCAST) can play a valuable role in working with the Director of OSTP in addressing the adequacy of the knowledge base. Questions that might be examined include whether opportunities provided by such programs as the International Geosphere-Biosphere Program and NASA's "Mission to Planet Earth" are being optimized from the perspective of environment-energy interactions. Also, research efforts to generate fundamental knowledge in such areas as plant biology and ecology need to be reconsidered and probably strengthened in the context of our best current understanding of trends in environment and energy. Finally, research needs to be developed that is focused on solutions as well as on understanding the situation.

2. Conduct an intensive review of federal monitoring efforts and responsibilities for global environment.

The new high-level mechanism and OSTP should take a much more active role to assure that high- quality programs of environmental monitoring are maintained and coordinated by relevant U.S. agencies and that there is international coordination of monitoring. Among the agencies responsible for monitoring are NASA, NOAA, EPA, the Forest Service of the Department of Agriculture, the Geological Survey of the Interior Department, and the National Science Foundation. In contrast to the encouraging status of the basic research coordination effort, the Task Force believes monitoring to be an

"The process by which policies are set and decisions made leaves much to be desired...[T]he degree of uncertainty surrounding the data on which the environmental decisions are based is often frightening. For example, many of the air quality models used to support regulatory decisions have enormous margins of error. Equally lacking is information about how well programs work; compliance statistics are notoriously incomplete, and monitoring of program implementation is problematic at best."
— William K. Reilly, Jr.[23]

area where effort has been seriously lagging.

There are many poorly known factors and relationships that enter into the environmental predictions upon which policy analyses and operational activities depend. Careful monitoring of sources and sinks of greenhouse gases, changes in cloud cover, ocean circulation, and other variables is needed because of the demands for greater precision in detecting environmental changes associated with the high stakes involved in policy decisions. The Task Force suggests that the new mechanism and OSTP (including PCAST) conduct an intensive review of the federal data collection and monitoring effort for global environment and make recommendations on its adequacy.

3. Further strengthen the capability of the State Department to analyze and to respond to foreign policy implications of issues in environment and energy.

Noting the increasingly international causes and consequences of changes in the global system, the Task Force recommends the enhancement of the capability of the Department of State to analyze and to respond to the foreign policy implications of issues concerning environment and energy. With increasing frequency, the State Department is participating in complex international negotiations involving matters such as depletion of the ozone layer, acid deposition, and climatic change. The State Department must have the internal capability to understand and evaluate the information provided to it by agencies such as DOE and EPA and by other governments and intergovernmental organizations. Its competence in the field must be sufficient to represent the views of the U.S. government to other governments and in multilateral forums. It is our view that unless its capability is enhanced, the Bureau of Oceans, Environment, and International Science (OES) in the State Department, even with a recent augmentation of staff, is currently stretched beyond realistic limits and may be overwhelmed by future demands, to the detriment of the United States.

4. Consider establishment of a new, independent, forward-looking institute for environmental analysis to serve government agencies.

The Task Force recommends that the government consider enhancing its capability for environmental analysis. The high-level Executive Office mechanism and other parts of the government would benefit from a stronger capability in environmental analysis that would be available when needed.[24] At present, there are major gaps in information available to the government, and the quality of impact assessment efforts can be greatly improved.[25] The analysis function could be fulfilled either through a central institute or through several centers of excellence in universities and other research institutions that are supported on a long-term basis. The center(s) should be independent and forward-looking, and governance should encourage all relevant federal agencies to have a sense of ownership, perhaps through some kind of consultative, interagency oversight group. Cooperation in the formulation, direction, and follow-up of studies would in itself help to improve lines of communication and coordination and integration of approaches. The substantive orientation should be toward energy efficiency and waste minimization and toward the development of methods for impact assessment and policy analysis that integrate environment, energy, and economics.26

CONCLUSION

In conclusion, the Task Force reiterates that wise institutional design, carried out promptly, may eliminate what is a much exaggerated and diversionary conflict between environmental quality and economic strength. Sound policies in such areas as waste minimization and energy efficiency, imaginative use of economic incentives, and promotion of engineering solutions that address potential problems through design at

the origin, rather than through retrofits at the "end-of-the-pipe," will strongly and simultaneously support economic growth, energy security, and environmental quality. A new mechanism is needed near the highest level of the Executive, paralleled by an initiative in the Congress, to bring this about. The Task Force believes the concepts outlined here can be the basis for decisive steps in this direction.

References

1. William K. Reilly, Jr., "A View Toward the Nineties," in P. Borelli, Crossroads: Environmental Priorities for the Future. Island Press, Washington DC, 1988, p. 97.

2. According to the Department of Commerce, the nation spent about $78 billion in 1986 on all forms of environmental protection, about two-thirds in industry. See K. D. Farber and G. L. Rutledge, "Pollution abatement and control expenditures, 1983-1986." Survey of Current Business, May 1988, p. 28. See also Congressional Office of Technology Assessment, "Serious Reduction of Hazardous Waste for Pollution Prevention and Industrial Efficiency." OTA-ITE-317, 1986.

3. C. A. Zraket, "Opening Remarks-Environmental Situation in the United States." In A. T. Amr, D. E. Egan, K. R. Krickenberger, and S. V. McBrien, "Pollution Prevention: Opportunities and Constraints" (Workshop Presentations and Summary). MTP-89W00006, August 1989. Available from The MITRE Corporation, Civil Systems Division, 7525 Colshire Drive, McLean VA 22102.

4. For more detail, see G. J. F. MacDonald, "Policies and Technologies for Waste Reduction and Energy Efficiency" in A. T. Amr, D. E. Egan, K R. Krickenberger, and S. V. McBrien, "Pollution Prevention: Opportunities and Constraints" (Workshop Presentations and Summary). MTP-89W00006, August 1989. Available from The MITRE Corporation, Civil Systems Division, 7525 Colshire Drive, McLean VA 22102. See also, J. H. Ausubel and H. E. Sladovich (eds.), Technology and Environment. National Academy Press, Washington DC, 1989.

5. John H. Sununu, "Engineers and Policy," in H. E. Sladovich (ed.), "Engineering and Human Welfare," National Academy of Engineering, Washington DC, 1990, pp. 28-29.

6. For views of the environmental movement on the assessment of successes and failures so far, see Peter Borelli (ed.), Crossroads: Environmental Priorities for the Future. Island Press, Washington DC, 1988.

7. See U.S. Environmental Protection Agency, "EPA's Use of Cost-Benefit Analysis: 1981-1986." EPA-230-05-87-028. Office of Policy Planning and Evaluation, Washington DC 20460, August 1987.

8. The need for a transition to more anticipatory management in the environmental field has been discussed at several conferences, for example, the 1984 Paris Conference on Environment and Economics of the Organization for Economic Cooperation and Development (OECD).

9. S. K. Friedlander, "Environmental issues: implications for engineering design and education." In J. H. Ausubel and H. E. Sladovich (eds.), Technology and Environment. National Academy Press, Washington DC, 1989.

10. See, for example, "Project 88: Harnessing Market Forces to Protect Our Environment: Initiatives for the New President." Senators Timothy Wirth and John Heinz, Chairmen. Available from the offices of Sen. Wirth (202-224-5852) and Sen. Heinz (202-224-6324). Washington, D. C., 20510. December 1988. For a summary, see R. N. Stavins (1989), "Harnessing Market Forces to Protect the Environment." Environment, Vol 31, #1, pp. 4ff. See also B. A. Ackerman and R. B. Stewart (1988), "Reforming environmental law:

The democratic case for market incentives," Columbia Journal of Environmental Law 13: 171-199, and R. B. Stewart (1988), "Controlling environmental risks through economic incentives," Columbia Journal of Environmental Law 13: 153-169.

11. See Congressional Research Service, "Using Incentives for Environmental Protection: An Overview," for a critical evaluation of incentive-based systems. Library of Congress, Washington DC, 2 June 1989.

12. The Committee on Science, Engineering, and Public Policy of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine is carrying out a comparable assessment of the climate change question for the U.S. Congress. This study is also global in scope and is expected to be completed in late 1990.

13. The General Accounting Office (GAO) report "Global Warming: Administration Approach Cautious Pending Validation of Threat" examines the extent and adequacy of federal agency coordination, effectiveness of U. S. participation in international activities, and the status offederal agency actions required to address congressional concerns. GAO/NSIAD-90-63, January 1990. Available from GAO, POB 6015, Gaithersburg MD 20877.

14. Robert M. White, "Technology and the Interdependence of Nations," in H. E. Sladovich (ed.) (1990), "Engineering and Human Welfare," National Academy of Engineering, Washington DC, p. 8.

15. For more detailed analysis, see the GAO report cited in note 13 above. For a historical summary of federal organization on the greenhouse issue until the summer of 1989, see Jesse H. Ausubel, "Federal Organization for Climate and Energy: A Brief History and Analysis," Sept. 1989. Available from Carnegie Commission on Science, Technology, and Government, The Rockefeller University, Box 234, 1230 York Avenue, New York NY 10021.

16. President George Bush, "U. S. Committed to Safe Environment," Current Policy No. 1249, Bureau of Public Affairs, Department of State, Washington, D.C. 20520.

17. Moreover, as noted in the GAO report, although the Climate Protection Act (PL 100-204, 1987) and the National Climate Program Act (PL 95-367, 1978) identify goals and agency responsibilities, such legislation functions effectively only in combination with high level executive guidance.

18. The Task Force notes the Congressional proposal (S. 201) for a Council on World Environmental Policy (CWEP). S. 201 abolishes the CEQ and transfers all responsibility to the new CWEP, chaired by EPA. The Council would be made up of two Presidential appointees and the heads of eleven agencies, with OSTP represented ex officio. Although the Task Force agrees with some of the objectives of such an arrangement, it may not be workable and may go too far in emphasizing global considerations rather than links among issues of environment, energy, and economics in a global context.

19. For a history of the origins of CEQ and the early intentions for it, see J. Whittaker, Striking a Balance. American Enterprise Institute, Washington DC, 1976.

20. Budget of the U.S. Government FY 1991, Section IIIF, pp. 127-128.

21. The Task Force notes H.R. 980, which creates a Council of Global Environmental Policy (CGEP) to coordinate development of national policies to abate, mitigate, and adapt to the impact of global environmental change. The Council would have eleven members, including the chair of CEQ, director of OSTP, and representatives of appropriate agencies. The chair of CEQ would serve as chair of CGEP. Although this arrangement might have some benefits, it does not appear to address the fundamental need to join issues of environment, energy, and economics on all levels,

whether national or global.

22. Russell E. Train, "Environmental Concerns for the Year 2000," paper prepared for the Congressional Research Service Symposium on "Congress in the Year 2000: The Policy Challenges." 18 October 1989. Available from World Wildlife Fund and The Conservation Foundation, 1250 24th ST NW, Washington DC 20037. This essay contains a broad examination of environmental issues through a Congressional lens

23. William K. Reilly, Jr., "A View Toward the Nineties," in P. Borelli, Crossroads: Environmental Priorities for the Future. Island Press, Washington DC, 1988, p. 94.

24. The concept for an institute of this type was proposed in conjunction with the original establishment of the CEQ. The passage of time has strengthened the argument for it, as the Executive Office repeatedly found itself improvising to address environmental questions
in the 1980s. Examples of issues that rose to high levels of political attention for which the Executive Office was hard-pressed to develop strong analytic preparation include acid deposition, nuclear winter, and marine oil spills. There have been several proposals for the related concept of a National Institute for the Environment, modeled on the National Institutes of Health. See, for example, Science 247: 24, 1990.

25. For further discussion of the need for improved tools for environmental policy analysis, see pp. 17-20 in R. W. Fri, "Energy and the environment: barriers to action." 25 July 1989. Available from Resources for the Future, 1616 P St NW, Washington DC 20036.

26. For particular issues that such an institute might address, see G. J. F. MacDonald in note #4 above.

APPENDIX

The Greenhouse Effect: An Illustration of the Linkages of Environment, Energy, and Economy

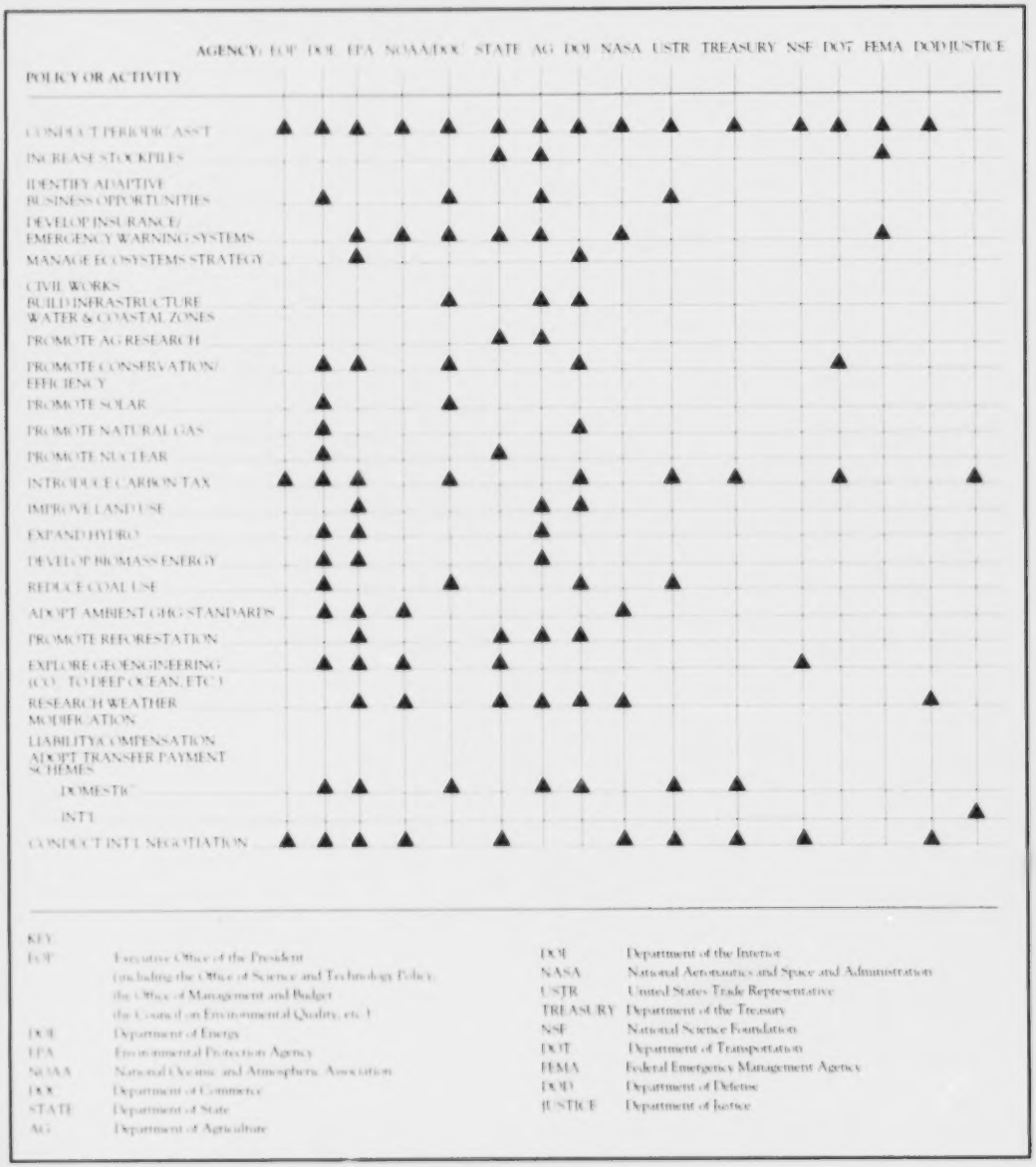
Since the start of human history, the climate of the earth has fluctuated only a small amount, perhaps ±1° C over the past 10,000 years, if the global average annual temperature is used as an indicator. Human activities are now increasing the concentrations of so-called greenhouse gases in the atmosphere to such an extent that considerable changes in the climate may be induced in coming decades. These changes may extend well beyond the climate variations to which current social, ecological, and agricultural systems have become accustomed. The largest source of carbon dioxide, the principal greenhouse gas, is the burning of fossil fuels, on which the world relies for some 90 percent of its energy. Deforestation is an additional source of greenhouse gas emissions and also reduces the capacity of the earth to re-capture carbon dioxide from the atmosphere. The United States accounts for about one-quarter of global greenhouse gas emissions.

There are many uncertainties in projecting the future emissions of greenhouse gases, the fraction of these gases that will remain in the atmosphere, the climate changes that will occur, and the consequences of the changes that will ensue. There is widespread agreement on the need to understand better all aspects of the issue. There is also growing pressure to take action, both to restrain emissions and to facilitate adaptation to climatic change, which to some extent looks unavoidable. Such actions will necessarily relate to some of the deepest and most pervasive economic structures of our society.

Everyone is an interested party in climatic change. All people contribute to the increase in greenhouse gases through their everyday activities of travel, cooking, keeping warm or cool, and so forth. And, of course, all people care about transformations of the earth's environment on the scale that many experts now speculate. From an economic point of view, the greenhouse issue is a concern for farmers everywhere, but also for—just to name a few—coal and oil companies, electric utilities, managers of water supply systems, and many others whose livelihoods might be affected both adversely and perhaps beneficially. Nearly every part of government is concerned about the greenhouse effect, for it relates to decision making about energy, transportation, land use, agriculture, conservation of nature, tax policy, and international peace and stability (see Table 1).

There will be no single "solution" to the greenhouse effect. Many policies will be considered. These might include, for example, taxes on carbon to favor shifts from carbon-heavy coal and oil to carbon-light natural gas and movement to non-carbon fuels; incentives and regulations for energy efficiency, management of water supply and demand, reforestation, and prudent land-use and coastal zone management; and development of crop strains that are robust in the face of climate variation. The need is for a package of policies that is itself efficient and timely as well as fair in dealing with conflicts that will arise, because any "climate policies" will have significant implications for the distribution of wealth and burdens. Estimates of the costs of substantial limitation of greenhouse gas emissions run into the hundreds of billions of dollars per year. The need for knowledge and analysis is clear. The United States, alone and as a partner in a global effort, must be organized for the acquisition and validation of this knowledge and other inputs into a sequence of decisions about the greenhouse issue that will be a continuing feature of our political life far into future.

Table 1: Selected federal agencies' involvement in policies and activities related to the greenhouse effect



KEY

EOP	Executive Office of the President (including the Office of Science and Technology Policy, the Office of Management and Budget, the Council on Environmental Quality, etc.)
DOE	Department of Energy
EPA	Environmental Protection Agency
NOAA	National Oceanic and Atmospheric Association
DOC	Department of Commerce
STATE	Department of State
AG	Department of Agriculture
DOI	Department of the Interior
NASA	National Aeronautics and Space and Administration
USTR	United States Trade Representative
TREASURY	Department of the Treasury
NSF	National Science Foundation
DOT	Department of Transportation
FEMA	Federal Emergency Management Agency
DOD	Department of Defense
JUSTICE	Department of Justice

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